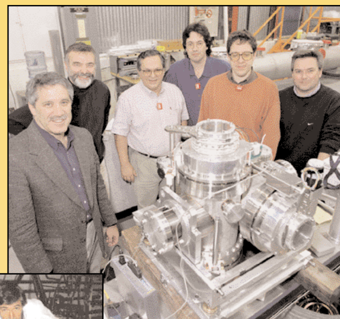
Forward Proton Detector For The DZero Collider Experiment

High-energy proton-antiproton collisions usually result in the destruction of the initial proton and antiproton, leading to bursts of new particles. Occasionally, however, one of the initial particles survives the interaction while the other particle breaks up and forms new particles. Called a diffractive scattering process and first observed 30 years ago, this type of interaction is not well understood. Attempts of explaining the phenomenon within the theoretical framework of strong forces, which are mediated by force carriers called gluons, have failed so far.



Alberto Santoro (third from left) and Hélio da Motta Filho (fourth from left) present the Forward Proton Detector to American experimenters.

Mário Vaz and Newton de Oliveira during the installation of the Forward Proton Detector at the Tevatron.

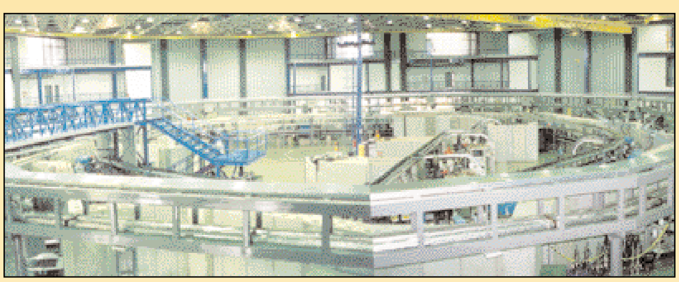
Hélio da Motta Filho works on the Forward Proton Detector at Fermilab.

Studying diffractive collisions is a daunting task as the surviving particle leaves the collision area in forward direction with a very small angle of deflection, very close to the beam of oncoming particles. In collaboration with European and American institutions, Brazilian scientists have developed a Forward Proton Detector that can be placed very close to the oncoming beam, positioning it inside the high-vacuum beam pipe. The FPD is located about 200 feet away from the collision point, about 180 feet outside the 5000-ton DZero detector that surrounds the collision area. The complementary techniques of the FPD and DZero detectors allow to record large numbers of diffractive processes.

The FPD consists of Roman pots. These devices measure direction and energy of the unscathed particle that escapes a diffractive collision. The pots can be moved close to the beam by a remote-controlled positioning mechanism. During Tevatron Run II, which starts in March 2001, they will be recording data for the first time.

Building the Roman pots required innovative design and state-of-the-art technology. Since the pots are operated very close to the beam, they must withstand intense radiation exposure. In addition, the installation is not allowed to damage the high-vacuum environment of the beam pipe.

The Brazilian contribution to the FPD came from researchers at six institutions: Centro Brasileiro de Pesquisas Físicas, Universidade Federal do Rio de Janeiro, Universidade do Estado do Rio de Janeiro, Universidade Estadual Paulista, Universidade Federal da Bahia and Synchrotron Light National Laboratory (LNLS).



View of the LNLS Synchrotron in Campinas, São Paulo, Brazil.